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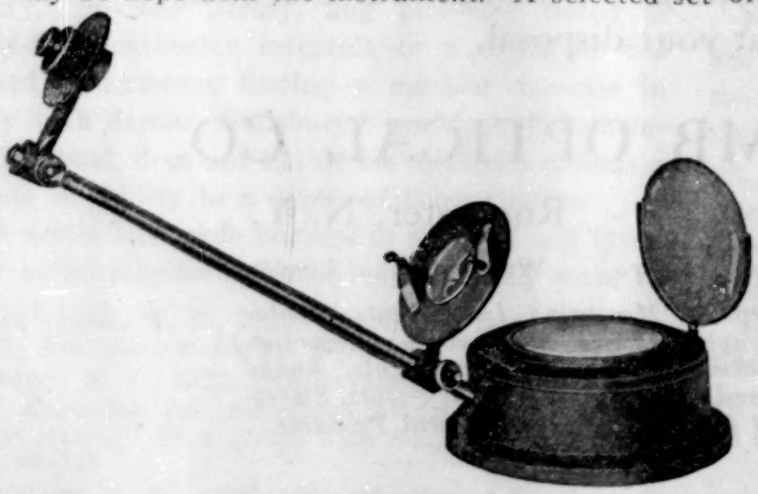

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Science News viii

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ARTHUR GORDON WEBSTER

THE death of Professor Arthur Gordon Webster by his own hand on Tuesday, May 14, was to all scientific circles in this country one of the most shocking and astonishing events of the kind that could have happened.

Few Americans have done more than Webster to promote the higher study of physics in this country. He had remarkable gifts and corresponding accomplishments; and, like other men who have been largely effective, he came at the right time for the exercise of his powers.

He was a scholar and a teacher rather than a discoverer or explorer in science. He acquired knowledge easily, copiously, joyfully, and he imparted it in the same way, though he was perhaps somewhat impatient of the drudgery and seclusion of original research; and America needed such a man when he came on the scene.

Rowland and some others, but Rowland more than any other or all others, had already shown the way and set the fashion of experimental investigation for young physicists in American universities; but Rowland was hardly a systematic scholar and was certainly not a systematic teacher. His famous remark, "*I neglect them,*" described accurately his method of dealing with his students, so far as general instruction was concerned, and the example he set in this respect might well have been, perhaps was, injurious to sound scholarship in this country.

European physical laboratories, the best of them, had still much to teach us, and of course many individual Americans had profited by this teaching. B. O. Pierce, for example, understood the matter and labored quietly within his personal sphere of action to improve conditions in America, but he was not the man to proclaim his gospel from the housetops.

Webster took his A.B. at Harvard in 1885, the first scholar in his class, with *summa cum laude* in both mathematics and physics. He remained, as instructor in mathematics, a year more at Harvard, in the course of which he undertook, naturally without great success, a new determination of the mechanical equivalent of heat. Then he went to Berlin to study under Helmholtz. Professor Pupin, in his interesting autobiography, *From Immigrant to Inventor,* tells of meeting him there and of being induced to accompany him to Paris for a few weeks, "to see what physical science was doing at the Sorbonne and at the

Collège de France, and to compare the academic world of Paris with that of Berlin." It is clear enough, on this and other evidence, that Webster did not confine himself closely to the laboratory of Helmholtz or even to the study of experimental physics. He puts himself down in *Who's Who* as having studied during the years 1886–90 at Berlin, Paris and Stockholm. He was four years, instead of the more usual three, in getting his Ph.D. at Berlin, and even so his thesis was, I believe, a philosophical or theoretical disquisition rather than the record of experimental research accomplished. On the other hand, he gained an exceptionally broad and accurate knowledge of the state of physical and mathematical science in Europe, and became remarkably proficient in the use of several languages.[1]

Returning to America in 1890, he became a member of the physics staff at Clark University, then a new institution, as junior to Michelson. His next fifteen years were especially fruitful. Lecturing, from the start, on the higher mathematical aspects of physics, he became, I believe, head of the department and director of the physical laboratory in 1892, when Michelson was called to Chicago. In 1893 he completed an important piece of work, "An Experimental Determination of the Period of Electrical Oscillations,"[2] which won for him, by an award announced in 1895, the Elihu Thomson Prize of 5,000 francs. The details of this event are interesting. Thomson had received, in a competition announced in 1889 by the City of Paris, a prize of 5,000 francs for his watt-meter. He then offered the same amount for a new competition, as a prize for the best work on one of four important problems in electricity. The committee for the award consisted of J. Carpentier, Hippolyte Fontaine, Hospitalier, Mascart, A. Potier and Abdank Abakanowicz. The memoirs were to be presented on or before September 15, 1893, and four were offered, one in German, one in French, and two, numbered at first three and four, respectively, in English. The committee awarded the prize to the fourth paper, with words of especial praise for the author, who proved to be Webster. But number three was considered also worthy of a prize, and ultimately, through the generosity of Professor Thomson and the French and English Thomson-Houston Companies, received also 5,000 francs. This memoir was on the same subject as that of Webster, and was the joint work of Oliver Lodge and R. T. Glazebrook.[3]

[1] In after years he used to address in their own tongue assemblies of Greeks in Worcester.

[2] The paper describing this work is to be found in the *Physical Review*, Vol. 6 (1898) of the First Series, at p. 297.

[3] I have taken this account mainly from SCIENCE, Vol. I (1895), p. 190.

Webster's work in this case was, as he clearly states, an experimental verification of the formula given years before by other men, of whom he mentions Helmholtz and Schiller. It is a good example of the sort of experimental problem toward which he inclined and for which he was, no doubt, best fitted, that is, a problem requiring exact measurements in a field that could be explored mathematically in advance. And to say this is to give him high praise, with the implied admission, perhaps, that he was not a man likely to undertake venturesome explorations or to introduce distinctly new ideas. The following passage taken from his illuminating, and in every way admirable, review[4] of the English edition of Hertz's *Electric Waves,* is relevant here: "The proper order of procedure [in experimental work] may be stated, 'Think, calculate, plan, experiment, think—and first, last, and all the time, *think*.' The method often pursued is: 'Wonder, guess, putter, guess again, theorize, and above all avoid calculation.'" This is good, safe counsel, and probably it was much needed in America at the time it was given, though the world doubtless owes a good deal to the class of unsystematic and usually unsuccessful theorizers who wonder, guess, putter, and guess again.

In 1897 Webster published his *Theory of Electricity and Magnetism,* based upon the lectures he had been giving during six years of teaching at Clark University. This treatise was high above the level of any preceding American text-book in this field, with the exception of B. O. Pierce's *Newtonian Potential Function,* a work of narrower scope, which appeared first in 1886. The book is not, and does not profess to be, new in its subject-matter; it is rather the work of a highly competent and accomplished scholar gladly serving as guide to bring young men into the intellectual company of the great leaders of thought, to whom here as always he rendered loyal, ungrudging homage. The *Preface* ends thus: "If the book shall succeed in clearing up some of the difficulties generally encountered by the student and in inducing him to read the classical writings of Maxwell, Helmholtz, Hertz and Heaviside the object of its author will have been achieved."

In the same year he gave a course of public lectures, on *Electricty* and *Ether,* under the auspices of the Lowell Institute of Boston, no small honor for a man but 34 years old.

In 1899 he took a leading part in founding the American Physical Society, and I believe that he was the initiator of this movement, though I speak subject to correction by those who are more intimately informed regarding the matter than I am. At the organizing meeting, which was held at Columbia Uni-

[4] *Physical Review,* Vol. 3 (1895–6) of the First Series.

versity May 20, he was elected secretary and addressed the assembly in explanation of the call. He was made chairman of the committee chosen to draw up a constitution for the society, and in the permanent organization was made chairman of the council. Rowland was made president, Michelson, vice-president, and Merritt, of Cornell, secretary.

Webster contributed a great deal to the success of the society in its early years. When he did not present papers of his own, he listened diligently to those read by others, a duty occasionally neglected by some of us, and his frequent comments were appreciative and illuminating. Moreover, they were delivered with such vigor, and such evidence of high spirits, that they created a cheerful and lively atmosphere for what might have been, at times, a rather perfunctory and dreary program.

Few men, it seems to me, have so genuinely rejoiced in the nature and achievements of their science as Webster did in physics and the mathematics pertaining thereto. He used to speak of the higher revelations in this field of study almost in the spirit of the old hymn,

I love to tell the story of unseen things above.

And yet he was not over mathematical in his discussions; for he had what, in a review[5] of J. J. Thomson's *Electricity and Magnetism*, he describes as "the thorough knowledge of mathematics that enables one to express mathematical truths in plain language."

His standing among American men of science after a dozen years of his professional life is well shown by the fact that he was elected a member of the National Academy of Sciences in 1903, at the age of 39, there being at that time, I believe, only two younger members, George E. Hale and Theodore W. Richards.

His *Dynamics* appeared in 1904, and the same general comments can be made on this book that apply to his *Electricity and Magnetism*. In reviewing the *Dynamics*, for the Harvard Graduates' Magazine, I described the author as "one of the best spokesmen for physics and the mathematics most used in physics," and said further that, although at first sight the volume under discussion might appear to be intended for the mathematician rather than the physicist, closer examination showed it to be written with a very lively sense of the objective world. Though printed in English, the book was published by Teubner, of Leipsic, as volume XI in the Series *Lehrbücher der Mathematischen Wissenschaften*.

Webster was, in fact, especially interested in mechanics, and his later research work in general had to do with matters of a mechanical nature, such as the energy of sound waves and the pressure developed in the explosion chambers of guns.

[5] SCIENCE, Dec. 13, 1895.

It is clear that he had done a great deal in his first twenty years out of college. In dealing, very briefly, with the remainder of his life, I can hardly do better than repeat certain paragraphs from a letter I wrote to the Boston *Herald* soon after his death, and which appeared in that paper on May 20: Thus far we discover no hint of impending tragedy in the record of his career, but in the light of what has come at last it is not difficult to see that years ago he began to be, in some measure, the victim of his own gifts and attainments. If there had been some element of wholesome dullness in his make-up, just enough to show him early in life that he must not try to attend all meetings of physicists, understand all papers, and speak all languages, while conducting a research laboratory and teaching all the higher branches of his science in his own university, his early years would have been less brilliant, but perhaps his later ones would have been happier. With the tremendous advances and revolutionary changes that have marked the history of physics during the last two or three decades, the program which he had undertaken became too much for the powers of any man.

He probably saw this at the last, but when it seemed too late to change. He grew somewhat morbid, a state of feeling partly shown and partly masked by his humorous habit in speech and writing. Those who knew him well saw that he was depressed at times, and even despondent, but his physical vigor was so great, his bodily health seemingly always perfect, that no one appears to have realized how dangerously his mind was plunging, under cover of those sometimes extravagant bursts of humor that seemed the evidence of high spirits.

Arthur Gordon Webster was a good fellow, and an upright, blameless man. In thinking, so far as I can bear to think, of what his last days must have been, I recall the words of William James, who had known the depths of despondency, spoken to another man of like experience, "No one has a right to speak of life who has never felt the *fear* of life."

EDWIN H. HALL
HARVARD UNIVERSITY

GAME LAWS FOR THE CONSERVATION OF WILD PLANTS

REFERENCE was made in a recent number of SCIENCE (January 12, 1923) by Dr. Gager to the Vermont law of 1921 in which a list of over forty species of native ferns and flowering plants were specified as protected. The law prohibited general commercial collection of these forms but allowed limited gathering for scientific purposes. By inference, all species not mentioned in that list are considered sufficiently common so that their natural in-

crease may be expected to take care of any demand. As a matter of interest, it may be reported that this law seems already to have produced the desired result. Evidence from both botanical and commercial sources indicates that Vermont has ceased to be open territory for the activities of the collectors of rare plants.

Several other states may be reported as having laws of similar import, already passed or up for consideration. In Connecticut, the interests backing conservation have been instrumental in having rare plants recognized as wards of the state, with special emphasis on the state flower, mountain laurel (*Kalmia latifolia*). As long ago as 1867 Connecticut recorded a statute to protect the climbing fern (*Lygodium palmatum*), then widely sought for home decorations under the name of "Hartford fern." The new statutes, in addition to establishing a protected list of laurel, climbing fern and several evergreens, provide also that shipments of wild plants, legally sold as from private land, must bear definite indication of their source, and that written permission from the landowner must be filed with county officers.

Through the activity of the Fairfield (Conn.) Garden Club, a very attractive and effective pamphlet has been printed for general distribution throughout the state. The author is Mabel Osgood Wright (Mrs. J. O. Wright), and the pamphlet is designed to put emphasis on the use and the proper picking of flowers which are not in danger of extinction. The Connecticut situation has been further dealt with in an article in the *American Fern Journal* (*13*, 56–59, May, 1923) by the present writer, including a complete copy of the Connecticut statutes. This may be obtained reprinted as a leaflet of the Brooklyn Botanic Garden on request to the writer.

California also has a law, specifying general protection for a shrub largely in demand for Christmas decoration, Toyon berries (*Heteromalis arbutifolia*), and, in addition, practically all the wild flowers of Yosemite are protected, particularly the snow plant (*Sarcodes sanguinea*). Maryland has a comprehensive law on its books. Massachusetts proposed last year a law designed particularly to conserve the state emblem, the mayflower (*Epigaea repens*), but this failed of passage. It seems to have been poorly conceived, in part at least, as it provided fine or imprisonment for any sale of the mayflower, regardless of whether the seller had the legal right of ownership.

It needs to be realized that in the preparation of any protective law for rare plants the sharp distinction between animals as the property of the state and plants as the property of the landowner must be recognized. Wild animals, even though they may nest or burrow in one farm, ordinarily pass frequently beyond private boundaries. In the case of the migratory bird, the nation holds title as evidenced in recent laws; some even required international agreement for control. The plant, however, belongs with the land in which it grows, and no restriction may be placed on the farmer's operation of this land, except possibly in the case of weeds or poisonous plants where the police power of the state might be involved. Eventually, through the exercise of this police power, we shall see state control of forests on privately owned land, with definite regulation of methods of lumbering, replanting, etc. Such a law was introduced into the New York State legislature the past session but failed of passage.

A copy of a plant law recently proposed in Illinois has come to hand and seems to comprise in a brief statement all the desirable features of a general state law. Its wording is as follows:

A bill for an act. An act for the conservation of the wild plants of the state of Illinois. Certain plants not to be destroyed or sold—Penalty—

Be it enacted by the people of the state of Illinois, represented in the General Assembly: Any person, firm or corporation who shall, within the state of Illinois, knowingly buy, sell, offer or expose for sale any blood root (Sanguinaria canadensis), lady slipper (Cyprepedium parviflorum and Cyprepedium hirsutum), columbine (Aquilegia canadensis), trillium (Trillium grandiflorum and Trillium sessile), lotus (Nelumbo lutea), or gentian (Gentiana crinita or Gentiana Andrewsii), or any part thereof, dug, pulled up or gathered from any public or private land, unless in the case of private land the owner or person lawfully occupying such land gives his consent in writing thereto, shall be deemed guilty of a misdemeanor, and shall be punished by a fine of not less than $10.00 nor more than $100.00 and costs.

Limitation—Section 4. All prosecutions under this act shall be commenced within six months from the time such offense was committed, and not afterwards.

The twenty-year activities of the wild flower preservation societies and other similar organizations seem finally to be bearing rich fruit. Other recruits are joining. At the last annual convention of the Society of American Florists, held at Kansas City last summer, a communication urging wild flower conservation from the Garden Club of America was favorably received and the florists' organization went on record as supporting conservation. Similar action was taken by the Florists' Telegraph Delivery Association, representing the retailers' interests as the Society of American Florists represents the growers and wholesalers. Individual florists have even voluntarily agreed to refrain from the use of cut laurel in their store work.

The problems to be solved legally seem to be three: (1) The protection of rare forms from commercial collection by plant sellers; (2) increased penalties for sheer vandalism, and the invasion of private and

public property in the neighborhood of large cities; (3) provision for state supervision and enforcement of whatever laws are adopted. Another matter for state action is found in the establishment of increased areas of forest reservation. To be of value in plant protection, such reservations need to be large ranges. Small open park areas established as publicly owned land constitute a greater danger to rare plants than continued private ownership. When the west Green Lake near Jamesville, N. Y., was set aside as a state reservation, the public flocked there by the hundred and carried away most of the fern plants.

Absolute protection in the neighborhood of cities seems next to impossible, except by the establishment of guarded sanctuaries, plots of ground sufficiently large to afford a variety of habitats, where rarities may be maintained much as are valuable paintings, books, etc., under proper curatorial supervision. If the saving of some particular species constitutes an emergency, private initiative will probably be necessary, such as was responsible for the institution of Birdcraft Sanctuary, at Fairfield, Connecticut. An area of about ten acres was surrounded with a boy-proof, cat-proof fence; a competent warden was installed with dwelling inside, and the rare plants of the state are now being accumulated. This little park serves also as an extension of the local school system, and frequent class visits are made.

R. C. BENEDICT

BROOKLYN BOTANIC GARDEN,
BROOKLYN, N. Y.

CERTIFIED METHYLEN BLUE

THE Commission on Standardization of Biological Stains has begun the plan of certifying certain definite batches of different stains that are submitted to it for approval. In every case the certification is issued only for the batch of which a sample has been tested; hence any bottle of stain sold with the commission endorsement may be regarded as being of the same lot as the sample examined by members of the commission for the purposes stated on the label.

The commission is issuing two different forms of label and is giving companies the option of using either on batches of stain endorsed by the commission. One of these forms is to bear on it the name of the stain; the other bears nothing but the certification statement and is to be used in conjunction with a label printed by the manufacturer and approved by the commission. Cuts of these two labels accompany this article. Any other form of certification appearing on bottles of stains must be regarded as a spuricus statement, issued by the manufacturer or dealer without consulting the commission.

The different stains are to be taken up in this way one by one. Up to the present time methylen blue is the only one for which actual certification of this sort has been issued. The methylen blue samples submitted for testing by the commission were requested of the manufacturers to come up to the following specifications.[1]

(1) Samples of methylen blue to be considered must be of the so-called medicinal grade. It is expected that they will meet the U. S. P. requirements, but less weight will be attached to this consideration than to those following. In other words, a sample giving satisfactory performance will not be excluded because of failure in some particular to meet these chemical requirements.

(2) Methylen blue for the purpose above specified must contain at least 75 per cent. total color, this to be determined by one of these alternative methods:

(*a*) By measurement of the absorption of light of a solution of known concentration. The extinction coefficient of a solution of 10 parts of dye in 1 million parts of water, when measured in a 1 cm. layer at wave length 660 must equal or exceed 1.35.

(*b*) By reduction with titanous chloride. When reduced by titanous chloride in an atmosphere of carbon dioxide, 1 gram of the dye must consume at least 4.69 cc. normal titanous chloride solution.

(*c*) An alternative volumetric method by means of standard iodine solution is under investigation by the Association of Official Agricultural Chemists and is expected to be made available in the near future.

(3) The methylen blue must have no solvent action on casein. This is to be determined as follows: Prepare two 1 per cent. solutions of this stain, one in distilled water, the other in tap water. Place single drops of skimmed milk on each of two clean glass slides and smear each drop over a surface of about one square centimeter so as to form a very thin film of milk; allow this film to dry without heat or at a temperature not over 60° C., immerse for about a minute in xylol to dissolve the fat, then for the same length of time in alcohol to coagulate the casein. After this immerse one slide in the distilled water solution of methylen blue and the other slide in the tap water solution, allowing them to stand for three minutes; at the end of this period there should be no action of the stain on the casein.

(4) The methylen blue should stain the diphtheria organism in any of the types of solutions ordinarily employed. It should be tested as follows: Prepare three solutions of the stain, one a 1 per cent. solution in distilled water, the second a mixture of three parts saturated alcoholic solution to 10 parts of distilled water, and the third three parts of saturated alcoholic solution to 10 parts of 0.01 per cent. NaOH.

[1] These specifications, so far as they refer to optical properties, are subject to revision in the near future.

Prepare three slides of a fresh culture of a diphtheria organism; stain one slide in each of these three solutions for two or three seconds only, *i.e.*, just as briefly as the stain can be poured on and poured off, and wash each slide immediately. Examined under the microscope all three of these preparations should show deeply stained bacteria with the characteristic metachromatic granules sufficiently distinct to insure accurate diagnosis.

(5) The sample should prove satisfactory for histological use. No exact method for determining this can be given, but the sample must be submitted to one or two experts in histological technic in order to get their judgment.

(6) It must be understood that these standards refer to samples to be used for ordinary bacteriological and histological staining. Special standards for methylen blue used in vital staining will undoubtedly be necessary. These standards, however, have not yet been determined.

Approval for bacteriological and general staining has been given samples of methylen blue submitted by the following concerns:

Dye Stuffs Laboratory Co., Cleveland, O.
Empire Biochemical Co., N. Y. City.
Harmer Laboratories Co., Lansdowne, Pa.
Hartman-Leddon Co., Philadelphia.
National Aniline and Chemical Co., N. Y. City.
Providence Chemical Laboratories, Providence, R. I.

In every case the manufacturer has given assurances that there is a sufficient stock of the batch tested to meet the ordinary demand for several years; the certification applies only to the batch tested. These lots of methylen blue are now on the market by all the companies just mentioned and will soon be obtainable from any supply house. In obtaining them it should always be stated that the methylen blue certified by the commission is desired.

All inquiries concerning the certification or reports of unsatisfactory results with them should be addressed to the chairman of the commission, Lock Box 299, Geneva, N. Y. Further work on methylen blue is already in progress, especially as to the type necessary for certain histological purposes for which the grade represented by these six samples seems to be partly unsatisfactory.

Now that the work on stains has reached a point where certification has begun, it seems appropriate to express acknowledgment to one concern whose assistance has been invaluable from the beginning. The Will Corporation, of Rochester, N. Y., through the personal interest of its treasurer, Mr. R. T. Will, has put much time and facilities at the disposal of the commission, without which the early stages of the work would have been almost impossible. The services of this company have been entirely disinterested, and it has even proved that the work of the commission, in calling attention to the specialists in biological stains, has considerably diminished the sales of the Will Corporation in this line. For this reason a public acknowledgment of their services to the work seems to be the least return that can be offered them.

H. J. CONN, *Chairman,*
Commission on Standardization of Biological Stains
GENEVA, N. Y.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE PHILOLOGICAL SCIENCES

IN conformity with action taken by the council of the association at the recent Boston meeting, Professor W. A. Oldfather, professor of classics in the University of Illinois, has been asked to accept and has accepted the chairmanship of a special committee to study and report on ways and means by which the association may be able to assist in the progress of the philological sciences. Professor Mark H. Liddell, professor of English in Purdue University, has accepted the secretaryship of this special committee.

Since its birth seventy-five years ago it has been the consistent endeavor of the American Association for the Advancement of Science to foster and coordinate all scientific investigations which have for their end the correlation of observed facts under demonstrable laws. But in 1848 the phenomena of language did not come within the scope of this aim. For language was then generally regarded either as a reflection of metaphysical categories beyond the ken of science, or as an ingenious invention designed to facilitate human intercourse.

Later, when the study of the biological and psychological phenomena that include those of language had become subject to rigorous scientific method, the study of language continued to be popularly regarded as possessing only pedagogical or pedantic value. Its fundamental criteria were supposed to be morphological and practical rather than scientific, and its scientific conceptions were subsumed under the head of comparative philology, or historical grammar.

The organizations which fostered this study have thus developed somewhat independently of the scientific stimulus which is the conspicuous feature of our modern intellectual life. They have hitherto chiefly depended for their growth upon special interests in the classics, or in the Oriental languages and literatures, or in archeology, or in anthropology, or in the practical study of foreign languages.

There is no reason for this isolation. For it is now generally admitted that man's language is subject to laws of development over which he has as little control as he has over those that determine his stature. It is also beginning to be apparent that his skill in employing his language as a developed means of thinking definitely conditions his efficiency in using it as a practical means of communication. Upon this efficiency depends the ultimate value of all human knowledge; for, though the truth of science may be attained in the first instance by forms of thinking in which actual words play an insignificant rôle, the attained truth to become a potent factor in the intellectual life of mankind must be put into those thinking forms which the laws of developing language have determined for it.

It is therefore very desirable that philological science shall become more consciously correlated with the other branches of scientific endeavor.

With these considerations in mind the American Association for the Advancement of Science is endeavoring to mark its 75th anniversary by encouraging a concerted effort on the part of American scholars to stimulate cooperative research in the linguistic sciences, and by inviting those representatives of these sciences whose scientific training gives promise of fruitful endeavor in this field to take a prominent part in its scientific activities. The association already includes in its various sections a considerable number of such persons, whose scientific work is increasingly contributing to the efficiency of the organization. The appended circular has recently been sent to a large number of those who may be interested in the organization of the philological sciences in the association. Suggestions are asked for in this connection, especially in regard to the following points: (1) The best way to advance the interests of American philological science. (2) The most practical method of stimulating research in this field. (3) Assuming these sciences to be represented in a special section of the American Association for the Advancement of Science, the most practical mode of organizing and conducting such a section. (4) Suggestions as to how philology may be advantageously represented at the 75th anniversary meeting of the association, to be held at Cincinnati, December 27, 1923, to January 2, 1924.

BURTON E. LIVINGSTON,
Permanent Secretary

THE PHILOLOGICAL SCIENCES IN THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The Executive Committee of the American Association for the Advancement of Science at its last meeting authorized a special survey of the philological sciences with a view to fostering philological research as a cardinal feature of the Association's activities. This leaflet is sent to those interested in the philological sciences, with the hope of enlisting their support for this movement.

Philology has long been a field of scientific research whose principles and methods are as clearly formulated and definitely organized as those of chemistry or biology. American contributions to the progress of this science have been conspicuous in their quality and extent. The scientific study of language, moreover, apart from its relation to literature, has played an important rôle in the history of American culture.

The fundamental data of language are also fundamental data in other fields of scientific study. For in its physical aspects language depends upon certain forms of sound-waves which are significant in the determination of its fundamental elements; in its biological aspects it depends upon certain types of organic development which make the production and reception of these stimuli natural to the functional activities of the human species; in its psychological aspects it depends upon the generic sensitivities of the human ear to speech-sound impulses in association with conceptual processes, and upon other psychic reactions induced by them, thus forming the most highly developed function of the individual consciousness; and in its social aspects, once unified and generalized by various groups of peoples, it records in permanent form their developing generic concepts and ideals with a clearness and definiteness not to be found in other records of ethnic activities.

The essential significance of these phenomena is to be ascertained from the scientific study of language itself in its various actual conditions and in its various developmental stages during the period since it has been a matter of record. A clear recognition of their interdependencies and a successful solution of the fundamental problems which grow out of them will surely be facilitated by an organization whose work is closely associated with progress and research in the related fields already well represented in the American Association for the Advancement of Science.

We therefore regard the effort of the American Association for the Advancement of Science to organize and foster research in the philological sciences as being likely to conduce to the advancement not only of philology but of science as a whole.

M. H. LIDDELL,
Professor of English, Purdue University
G. L. KITTREDGE,
Professor of English, Harvard University
C. H. GRANDGENT,
Professor of Romance Languages, Harvard University
W. A. OLDFATHER,
Professor of Classics, The University of Illinois
L. J. PAETOW,
Professor of Mediaeval History, The University of California
A. V. W. JACKSON,
Professor of Indo-Iranian Languages, Columbia University
C. D. BUCK,
Professor of Indo-European Comparative Philology, The University of Chicago

SCIENTIFIC EVENTS

CHEMICAL BIBLIOGRAPHY OF BIBLIOGRAPHIES

A RÉSUMÉ of the literature of the problem in which he is interested is the first need of every research worker in the field of chemistry and chemical technology, as well as in other fields of science. To meet this need it is necessary either to find or compile a bibliography of the subject. Unless the problem is very specialized, or of very recent interest, the chances are that somewhere is a list of references, more or less complete, bearing directly or indirectly upon the topic. To believe that it is *somewhere* is an incentive to the search, but to know *where* it is, is to eliminate the search and arrive at the goal.

Books or articles which are primarily bibliographic are so noted in various abstract journals and indexes and are, therefore, easy to find, but a list of references appended to an article or a book, however valuable or complete, is seldom mentioned in the abstract of the article or the index of the journal, and may be entirely lost as a bibliographic aid.

About two years ago the Research Information Service of the National Research Council enlisted the help of several men in the preparation of a key to scientific bibliographies, each man undertaking to prepare the work in his respective science. The bibliography of bibliographies on geology is now in press and active work is under way in those for chemistry and chemical technology, astronomy and physics.

In the field of chemistry and chemical technology about 6,000 references have already been collected, including separate bibliographies, lists of references appended to articles or books and comprehensive reviews of the literature. This field is so wide and the subjects covered so numerous that the cooperation of the specialists in the various branches would be very desirable. If you, the reader, have references to bibliographies in your special field you will facilitate the completion of this work by sending such references to the compiler of the Bibliography of Bibliographies in Chemistry and Chemical Technology at the National Research Council. Any annotation which you may make on the completeness or value of the refcrences will be appreciated.

Work is being pushed toward the early publication of this bibliography at which time notices will appear in all the scientific and technical journals so that those interested may secure copies.

CLARENCE J. WEST

NATIONAL RESEARCH COUNCIL,
1701 MASSACHUSETTS AVE.,
WASHINGTON, D. C.

THE WALTER RATHBONE BACON SCHOLARSHIP

UNDER the terms of the will of the late Virginia Purdy Bacon, of New York, the Smithsonian Institution was bequeathed the sum of $50,000 to establish a traveling scholarship as a memorial to her husband, Walter Rathbone Bacon.

The secretary of the Smithsonian Institution has recently approved the rules which are to regulate the award of the Walter Rathbone Bacon scholarship for the study of the fauna of countries other than the United States of America. The amount available is the interest on the capital invested (about $2,500 a year), the incumbent to hold the scholarship not less than two years.

Applications for this scholarship, addressed to the secretary of the Smithsonian Institution, should be submitted not later than October 1, 1923. The application should contain a detailed plan for the proposed study, including a statement as to the faunal problems involved; the reasons why it should be undertaken; the benefits that are expected to accrue; the length of time considered necessary for the carrying out of the project; the estimated cost; and the scientific and physical qualifications of the applicant to undertake the project.

The scholarship will be awarded for a term of two years. If at the expiration of the term it is desired to extend the time, the incumbent shall make application a sufficient time in advance, accompanied by a statement as to the necessity for such extension.

All collections, photographs, records and equipment become the property of the institution.

The incumbent shall not engage in work for remuneration or receive salary from other sources than the institution or its branches during the period of occupancy of the scholarship.

W. DEC. RAVENEL,
Acting Secretary
SMITHSONIAN INSTITUTION

A PROPOSED AMERICAN INSTITUTE OF OCEANOGRAPHY

AT the meeting of the Regents of the University of California, held on June 19, Dr. T. Wayland Vaughan was appointed director of the Scripps Institution for Biological Research. Although the new director's incumbency dates from July 1, 1923, his work as a member of the United States Geological Survey makes it impossible for him to move to La Jolla and assume actual charge of the institution's affairs until January or February, 1924.

Dr. F. B. Sumner, of the staff of the institution, was at the same time appointed to act as director in Dr. Vaughan's absence.

As bearing on the significance of the selection of a director for the institution, the following from the last annual report of the retiring director, Dr. Wm. E. Ritter, submitted to the president of the university some weeks before the action of the regents, may interest readers of SCIENCE:

An important change of policy to accompany the change of administration has been recommended by the retiring director and favored by the outgoing and incoming presidents of the university.

The recommendation is that the new director be selected with sole reference to the work upon the ocean and its life and that as rapidly as may be without harm to any of the investigations now in progress, the program be made exclusively oceanographic, the understanding to be that both the biology and the physics (physics being understood to include every aspect of the ocean as such) be included in the program on an equal footing. The suggestion is that an Institute of Oceanography be aimed at that shall finally have a scope and character worthy of the Pacific, the greatest of the oceans; and worthy also of the greatness of the United States as a nation and of the State of California. Cognizance is taken of the fact that although the United States fronts extensively upon the two main oceans of the earth on both of which she is vitally dependent, there is not within her domain a single institution devoted to the science of the ocean.

It is recognized that the carrying out of so ambitious a plan would have to be a matter of years so extensive and expensive would be the manning and physical appliances necessary. But when viewed in the light of what has already been accomplished in this domain by the institution during the brief period of its existence, and with the small means at its command; and especially when the whole matter is viewed in the light of what has been accomplished in the same general domain by other instrumentalities in other parts of the world, it is not felt that the plan is unreasonably ambitious. It is confidently believed that under the right leadership something approximating what is suggested can be brought about.

The proposal, it may be said, has been widely discussed with scientific men of the country whose interests are kindred to those here involved, and also with Mr. E. W. Scripps and Miss Ellen B. Scripps, all of whom have endorsed it.

AWARD TO DR. SVEDBERG

IN recognition of his leadership as an international authority on colloid chemistry and his success in the direction of research work at the University of Wisconsin during the past semester, the University of Wisconsin has conferred the honorary degree of doctor of science upon The. Svedberg, of the University of Upsala, at the June Commencement. On presentation of Dr. Svedberg to the president, for the degree, Professor F. L. Paxson, chairman of the Committee on Award of Honorary Degrees, said:

The. Svedberg received his doctor's degree only sixteen years ago, yet to-day his laboratories in the ancient University of Upsala are recognized as the world's most active spot for the study of the formation and properties of colloids. Chemical science has advanced in those sixteen years. It has nearly revolutionized the arts of war; and the needs of war in turn have brought profound changes in the approach to chemistry. From the interactions of the two there is promise that the quiet life of mankind will forever be improved.

During the past semester, as a resident in the University of Wisconsin, Professor Svedberg has brought to his department a fresh scholarship and a new technique. He has continued here that peaceful conquest of his colleagues that has marked his career in Sweden. And the results of his inspiring teaching are already to be seen in a growing disposition to look to this university as a center for the study of the special field that he has mastered and illuminated.

PROFESSOR PAVLOV'S VISIT TO AMERICA[1]

THE three weeks spent in America by Dr. Ivan Petrovitch Pavlov, winner of the Nobel Prize for medicine in 1904, and one of the most distinguished physiologists in the world, have not been pleasant. He was robbed of $2,000 in a train in the Grand Central Terminal, was forced to become the guest of the Rockefeller Institute because of his predicament and then was refused a British visé to his passport because he was a Russian.

As a result, Dr. Pavlov, who will sail to-day on the White Star liner *Majestic,* will not be able to attend the Edinburgh Congress of Physiologists, where his presence was desired by his fellow scientists. With his son, Professor Vladmir Pavlov, he will leave the *Majestic* at Cherbourg under a French visé which was readily granted to him, and after a short stay in France will return to Russia.

Dr. Pavlov is a tall, distinguished looking man, straight despite his 75 years. He left Russia, where he conducts laboratories in Petrograd, to attend the Pasteur anniversary celebration in Paris. He came to this country three weeks ago and after a few days started for New Haven to visit friends. Few persons knew that he was in the country, for if they had he would have been welcomed by scientists here as a celebrated physiologist.

He and his son had hardly taken their seats on a train in the Grand Central Station when three men set upon the old man and snatched from him his pocketbook, containing all their funds, $2,000. The porter and the son attempted to catch them, but were unsuccessful, and the old man and his son left the train, perplexed as to what they should do in their predicament. They finally got in touch with Dr. P. A.

[1] From the New York *Times.*

Levene, of the Rockefeller Institute, and since then have been the guests of the institute.

When Dr. Pavlov attempted to get the British visé to his passport he was told that it could not be done. He was accompanied by Dr. Levene, who explained that Dr. Pavlov was not a Bolshevist, that in fact he was anti-Bolshevist, but the passport bureau of the British consulate maintained that they could not visé any Soviet passport without express instructions. Two visits were made by the Pavlovs and Dr. Levene to the consulate, on Thursday and again yesterday, but without success, the son explained last night.

In his Petrograd laboratories Dr. Pavlov has thirty doctors and other helpers working under his direction. Despite his anti-Soviet beliefs, the Soviet Government has protected him and aided him in maintaining his laboratories because of his scientific research. Recently the Soviet Government published his collected papers and distributed them. In recent years he has studied the psychology of animal instinct and formed theories of sleep and hypnotism. His chief researches deal with the physiology of the heart, secretion of the glands, digestion and the producing of gastric and pancreatic fluid.

SCIENTIFIC NOTES AND NEWS

DR. WILLIAM ALLEN PUSEY, emeritus professor of dermatology in the School of Medicine of the University of Illinois, has been elected president of the American Medical Association in succession to President Ray Lyman Wilbur, of Stanford University.

DR. CHARLES A. BROWNE, chemist in charge of the New York Sugar Trade Laboratory, has been appointed chief of the Bureau of Chemistry, to succeed Dr. C. L. Alsberg, now director of the Food Research Laboratory at Stanford University.

DR. WILLIAM W. KEEN completed fifty years of service on the board of trustees of Brown University on June 21. Dr. Keen, who is 86 years old, left for Europe, following the reading of a resolution, extending felicitations to him.

THE Board of Trustees of the University of Chicago has appropriated the sum of five thousand dollars for the expense in connection with the experiment now being conducted at Mount Wilson Observatory, California, by Professor A. A. Michelson, head of the department of physics.

A TRUST fund for establishing a fellowship in biological chemistry in the College of Physicians and Surgeons, Columbia University, to be named in honor of the founder of that department, Dr. William John Gies, will be presented at its twenty-fifth anniversary. The committee will also present to Professor Gies an illuminated book containing testimonial letters of appreciation from former students, and from friends in this country and Europe.

THE gold medal of the Royal Society of Medicine, awarded triennially to a scientist for contributions to the science and art of medicine, has this year been awarded by the council to Professor F. Gowland Hopkins, F.R.S., professor of biochemistry in the University of Cambridge.

DR. LIVINGSTON FARRAND, president of Cornell University, was elected president of the National Tuberculosis Association at its recent annual convention in Santa Barbara, Calif. President Harding and Colonel George E. Bushnell, U. S. Army, retired, were named honorary vice-presidents. Memphis, Tennessee, was selected as the next convention city.

AWARDS for the scientific exhibits at the American Medical Association meeting in San Francisco were made as follows: the gold medal to Dr. Frank Hinman and his associates at the University of California; the silver medal to Dr. Benjamin T. Terry, Nashville, Tenn. Certificates of merit were given to the U. S. Public Health Service; the department of anatomy, University of California, and the League for the Conservation of Public Health of California. The following were given honorable mention: Dr. Hans Lisser, head of the department of endocrinology, University of California Hospital, and Mr. Ralph Sweet, the Mayo Clinic; Dr. Harry J. Corper, Denver; Dr. Robert E. Farr, Minneapolis; Dr. Amedee Granger, New Orleans, and Dr. Irving F. Stein, Chicago.

W. NELSON SMITH, consulting electrical engineer of the Winnipeg Electric Railway Company, and John W. Shipley, professor of chemistry at the University of Manitoba, have been awarded the Plummer Medal by the Engineering Institute of Canada, for their two research papers entitled, "The Self-Corrosion of Cast Iron and Other Metals in Alkaline Soils" and "The Self-Corrosion of Buried Lead Pipes."

THE council of the Institution of Civil Engineers has made the following awards for papers read at the meetings during the year 1922–1923: Telford medals to Mr. H. W. H. Richards (London) and Mr. E. O. Forster Brown (London); a George Stephenson medal to Mr. Asa Binns (London); a Watt medal to Mr. A. B. Buckley (Winchester); Telford premiums to Mr. W. A. Fraser (Edinburgh), Mr. S. L. Rothery (Calexico, U. S. A.), Mr. Mark Randall (Johannesburg), and Mr. D. E. Lloyd-Davies (Cape Town); an Indian premium to Mr. D. H. Remfrey (Calcutta); a Manby premium to Mr. F. M. G. Du-Plat-Taylor (London), and a Crampton prize to Mr. F. W. Jameson (Kimberley).

DR. B. A. KEEN, head of the physics department of the Rothamsted Experimental Station, has been appointed assistant director of the station.

DR. GEORGES DREYER, C.B.E., F.R.S., professor of pathology in the University of Oxford, has been appointed a member of the Medical Research Council in the vacancy caused by the resignation of Major-General Sir William Leishman, F.R.S., consequent on his appointment to be director-general, Army Medical Services.

PROFESSOR GEORGE HALCOTT CHADWICK, for the past nine years in the department of geology at the University of Rochester, has resigned in order to accept a research position with the Empire Company, at Bartlesville, Oklahoma.

DR. CASIMIR FUNK has accepted a call to organize a department of nutrition in the State Institute of Hygiene in Warsaw, Poland. He sailed on July 13 from Quebec and is planning to stay away two years.

DR. C. N. FENNER, of the Geophysical Laboratory of the Carnegie Institution of Washington, is spending the summer in the Katmai region, Alaska, to continue his studies of the phenomena of the 1912 eruption of Katmai volcano.

OLAF P. JENKINS, associate professor of economic geology, State College of Washington, is making a geological examination of the coals of Skagit County, Washington, for the division of geology of the Department of Conservation and Development. This is a continuation of the work he did in Whatcom County last summer, the report of which is now in the hands of the state printer.

DR. ARTHUR KNUDSON, professor of biological chemistry in the Albany Medical College, sailed from Montreal on July 6 for Edinburgh. After attending the International Physiological Conference at Edinburgh he will travel in northern Europe. In the autumn he expects to return to the University of Cambridge where he will spend several months in study and research.

DR. E. R. DOWNING, associate professor of natural science in the School of Education of the University of Chicago, who has been in Europe the past nine months studying the teaching of science in European schools, has returned.

AT the invitation of the Rockefeller Institute, Dr. Diego Fernández Fajardo of Yucatan will visit New York and the institute.

PROFESSOR JOHN MERLE COULTER, head of the department of botany at the University of Chicago, has been asked by a committee in New York representing a committee of educators in China and a university in Japan to spend six months in Japan and China lecturing at the colleges and universities of those countries. It is expected that he will address audiences of a more popular character as well as bodies of students and teachers. It is expected that Professor Coulter will speak on subjects pertaining to his own special field of study, botany; on larger questions pertaining to science in general; and on the relations of science to religion and civilization.

DR. CHARLES SHEARD, head of the division of ocular and professional interests of the American Optical Company, Southbridge, Mass., gave a lecture on the evening of June 21 before the Mayo Foundation Chapter of the Sigma Xi, Rochester, Minnesota, on "The physiological and pathological effects of radiant energy upon the human eye."

A REPRESENTATIVE meeting was held on June 1 at the Royal Society of Medicine, at which it was decided to establish a memorial to the late Professor A. D. Waller and Mrs. Waller, in the form of a fund to be used for the promotion of scientific research. In recognition of their close association with the London School of Medicine for Women, where Professor Waller succeeded Sir Edward Sharpey Schafer as lecturer in physiology, and Mrs. Waller was first a student and afterwards a member of council, a position which she held to the last year of her life, it was decided that the research fund should be entrusted to, and administered by, the council of that school. A committee was formed to carry out this plan, of which Sir E. Sharpey Schafer is chairman.

WE learn from *Nature* that in order to commemorate the late Dr. W. S. Bruce, the polar explorer, a Bruce Memorial prize has been founded by subscription among his friends and admirers. The prize, which will take the form of a bronze medal and money award, is to be given from time to time for notable contributions to natural science in the nature of new knowledge resulting from personal visits to polar regions. The prize will be open to workers of all nationalities, with a preference for young men at the outset of their careers as investigators.

THE Paris correspondent of the *Journal* of the American Medical Association reports that more than 15 million insignia (tags) were sold, for the benefit of the scientific laboratories, on Pasteur tag day. In the environs of Paris alone, the sum collected reached around 600,000 francs. There were several different forms of insignia, all of them designed by the best artists. The "tag" designed by Maurice Denis represents Pasteur leaning over his work table, examining with a microscope the milk he is taking from various bottles. In the foreground is the figure of a young

mother, seated, with a sick child on her lap, the drawn lines on her face betraying her great anxiety. The man who pushed back death is the theme developed by Paul Albert Laurens. His design represents an angel thrusting back the scythe swung by the skeleton figure draped in white, which has been for centuries the incarnate conception of death. Poulbot designed a vignette which represented a young boy bitten by a mad dog, thus recalling the discovery of the antirabic vaccine. Abel Faivre was content to perpetrate a pun. The scientist is represented with a halo about his head, while beneath are inscribed the words: *Le bon Pasteur* (the Good Shepherd).

CANON WILLIAM WEEKES FOWLER, vicar of Earley, Reading, England, known for his work on the Coleoptera, died on June 3, at the age of seventy-four years.

M. K. LOWEGREN, the first professor of ophthalmology in Sweden, has died at the age of eighty-seven years.

PROFESSOR HEINRICH BORUTTAU, director of the Friedrichshain Hospital, Berlin, known for his work in physiological chemistry, and on the problems of nutrition, died on May 15, aged fifty-four years.

DR. HANS GOLDSCHMIDT, inventor of the Goldschmidt thermite process, died at Baden-Baden on May 21, aged sixty-two years.

THE French Association for the Advancement of Science holds its meeting this year at Bordeaux from July 30 to August 4.

THE New York State Horticultural Society, with a membership of several hundred prominent fruit growers scattered throughout western New York and the Hudson River Valley, will hold its summer meeting on the grounds of the New York Agricultural Experiment Station at Geneva on August 1.

UNIVERSITY AND EDUCATIONAL NOTES

GOVERNOR SMALL has signed the bill appropriating the sum of $400,000 to establish a medical research laboratory at the University of Illinois.

AT the annual commencement exercises of the Northwestern University on June 18, it was announced that $100,000 had been received under the will of Mrs. G. F. Swift, and a like amount from Elbert H. Gary, John C. Shaffer and "A Friend."

A TRAVELING fellowship in medicine has been established at the Cornell University Medical College for 1923–1924 amounting to $2,000. It is available for men and women who have graduated from Cornell within ten years or who are graduates of other medical colleges within ten years who are now attached to the instructing staff of this college. This fellowship has been awarded to Harold Edwin Himwich, who obtained the degree of B.S. from the College of the City of New York in 1915 and the M.D. degree from Cornell University in 1919.

CHARLES W. PUGSLEY, assistant secretary of agriculture, has submitted his resignation, effective on October 1, to accept the presidency of the South Dakota State College of Agriculture and Mechanical Arts at Brookings.

AT their meeting on June 18, the trustees of Cornell University appointed Dr. Robert M. Ogden, professor of education, dean of the College of Arts and Sciences to fill the vacancy which has existed since the resignation of Professor Frank Thilly, professor of philosophy.

RICHARD E. SCAMMON, Ph.D., has been appointed acting director of the department of anatomy of the University of Minnesota during the year's absence of Dr. Clarence M. Jackson, who will serve as chairman of the medical division of the National Research Council during the coming year.

DR. BOWMAN C. CROWELL, of Charleston, S. C., has been appointed professor of pathology in the Jefferson Medical College of Philadelphia, to succeed Dr. William M. L. Coplin, who has resigned.

DR. H. H. WILLARD has been appointed full professor of analytical chemistry in the University of Michigan.

MR. E. C. WILLIAMS has been appointed to the Ramsay Memorial chair of chemical engineering at University College, London. He has been research chemist to the joint research committee of the University of Leeds and the National Benzol Association.

DISCUSSION AND CORRESPONDENCE

PHOTOGRAPHIC PLATES FOR THE EXTREME ULTRA-VIOLET

IN recent years there have been a number of attempts to improve the photographic methods, perfected by Schumann, used in the investigation of the ultra-violet, so far without any very striking results.

Recently Mr. David Mann and I have been making some experiments with the daguerreotype process. The results, though interesting, are so far of no great practical value. It is not difficult to prepare a surface which will be very sensitive in the region about

wavelength 1850 AU, and on two or three occasions we have obtained records extending to wavelength 584 AU, but in general the behavior of the plates in the extreme ultra-violet is capricious and unsatisfactory.

Duclaux and Jeantet (*Journal de Physique*, II, 1921, p. 154) have described a way of "Schumannising" an ordinary dry plate by treating it with sulphuric acid, and recently Aston has referred to the same process. M. Duclaux has been so kind as to send me some specimens of the results he has obtained. He informs me, however, that he prefers another method which he and his colleague have discovered and which was described in their article just cited. His experiments were confined to the region of the spectrum which may be investigated with a quartz prism spectrograph; I have continued them into the extreme ultra-violet.

The procedure is extremely simple. A fast commercial photographic plate—I have employed a "Seed 30"—is coated with a thin film of a colorless paraffin oil; it is then exposed in the usual way in a vacuum spectroscope, the oil is removed with acetone and the plate is developed. The results are nearly, though not quite, as good as those which I have obtained with the most sensitive Schumann plates prepared according to the old method; it is quite easy to get a record of the strong helium line at 584 AU.

The success of the process evidently depends on fluorescent action; I have tried a number of different kinds of oil and I find that "Nujol," a very pure oil sold in this country for medical purposes, yields good results.

I feel sure that this discovery of Duclaux and Jeantet will prove a real blessing to all spectroscopists who work in the extreme ultra-violet.

THEODORE LYMAN

JEFFERSON LABORATORY,
HARVARD UNIVERSITY,
JUNE 28, 1923

THE PHYSICO-CHEMICAL BASIS OF PSYCHIC PHENOMENA

TO THE EDITOR OF SCIENCE: A paper entitled "Physico-chemical basis of psychic phenomena," by Hughes and King, in SCIENCE, May 18, 1923, touches on a problem of the most fundamental importance. For the sake of those who have been unable to follow the literature of nerve physiology I believe that certain comments on this paper are appropriate. The article in question begins with the sentence, "Ever since Galvani discovered the relation between an electric current and muscular action, there has been a feeling among scientists that the nerves are electrical conductors and that nerve impulses are really electrical currents." To a physiologist acquainted with the work of Bernstein,[1] Brünings,[2] Gotch,[3] Lucas,[4] Adrian[5] and Lillie[6] this sentence makes somewhat the same impression that would be conveyed to a physicist by such a statement as this, "Ever since the days of Franklin there has been a feeling among scientists that electricity is the cause of magnetism."

Since the work of DuBois-Reymond and Bernstein the intimate and fundamental relation between the nerve impulse and the electrical disturbance which marks its progress has been known, although not as yet fully understood, much as the intimate relation between electricity and magnetism has been known since the days of Oersted and Faraday. On the other hand the last possibility of explaining the nerve impulse as an electric current along the fiber in the same manner as it is conducted along a metal wire was definitely swept away by the research of Adrian in 1912[5] in which he showed conclusively that the energy of the nerve impulse comes not from the stimulus, but from the nerve fiber itself, thus proving that the nerve impulse belongs to an altogether different class of disturbance from the current in a wire. This fundamental experiment of Adrian's in a somewhat simplified and modified form is now performed as a class exercise by medical students in more than one university in this country. In 1914 Adrian,[5] by a wholly different line of experiment, established the all-or-nothing law for the nerve impulse, not in the sense frequently ascribed to this law, that the impulse is of immutable magnitude under all conditions, but in the sense that it is independent of the strength of stimulus, provided this be adequate, depending only on the condition of the tissue at the moment. These researches were in a sense the culmination of work inaugurated by Gotch and Lucas which had already created strong presumptive evidence pointing towards the conclusion at which Adrian finally arrived. More recent work by Olmsted and Warner[7] has reinforced and extended these conclusions.

The precise nature of the nerve impulse is still unknown, but those properties just mentioned are well established. The principles which have emerged from these researches should not be confounded with speculative hypothesis; they are clearly established facts.

[1] "Untersuchungen über d. Erregungsvorgang im Nerven- und Muskelsysteme. Heidelberg," 1871.

[2] *Arch. f. d. ges Physiol.*, 1903, xcviii, 241.

[3] *Journ. Physiol.*, 1902, xxviii, 395.

[4] *Proc. Roy. Soc., B*, 1912, lxxxv, 495; "The Conduction of the Nervous Impulse," London, 1917.

[5] *Journ. Physiol.*, 1912, xlv, 389; 1914, xlvii, 460; 1920, liv, 1; 1921, lv, 193.

[6] *Physiol. Reviews*, 1922, ii, 1.

[7] *Am. Journ. Physiol.*, 1922, lxi, 228.

In view of this, any further attempt to prove that the nerve fiber conducts impulses in the same way that a wire conducts an electric current is merely a waste of time.

I do not mean to imply that the considerations mentioned in the paper of Hughes and King about two-phase systems of immiscible liquids and interfacial tension are not significant. They are doubtless highly significant. A careful study of recent papers by Lillie and Adrian will show the strong probability that the conduction of the nerve impulse depends on a semi-permeable state of the membrane surrounding the fiber and on the electrical difference of potential resulting therefrom. This semi-permeable state of the membrane in turn may probably depend in part on certain features of a two-phase system. Furthermore, experiments with narcotics are among the most likely to throw light on the important problem of the ultimate nature of the nerve impulse, but they should be conducted with due consideration for the great mass of facts already accumulated by a number of the ablest scientists of modern times—facts and principles which have already gone a long way towards giving us a picture of the nerve impulse. The neuropathologists and the psychologists already have something of a basis on which to work; but future research, coordinated with past research, will greatly strengthen this basis. In this work there is room for chemists, physicists and physiologists alike, if their work be properly coordinated.

ALEXANDER FORBES

WHAT IS A WEED?

THE word "weed" is usually defined as a plant growing out of place. This conception is not easily tangible for the following reasons:

(1) An innocent inquirer may think of a plant being out of place, in one or two respects—(a) As out of its natural habitat; for example, Jack-in-the-Pulpit in an open dry field, or, pigweed in a moist shaded forest; (b) As growing where some human being wishes it not to grow; for example, Bouncing Bet in the cabbage patch, or, rye in the wheat field. This latter conception (b) doubtless expresses the virgin idea of the formal definition, "A weed is a plant growing out of place."

(2) If so, we have an odd rule, under which any plant in the universe may instantly become a weed without the slightest change in character, habitat or position. Under this rule, a plant is a weed, not according to specific qualities nor by a definite concept in the mind of any man, but by human caprice; for example, the sugar maple trees become weeds when some man wishes to convert the grove into a corn field.

(3) To say that a weed is a plant growing out of place is to include in the weed realm all obnoxious parasitic plants. This is objectionable for two reasons: (a) In actual practice no person thinks of those dependent plants that cause wheat rust, corn smut, etc., as weeds. However, these species constantly grow where human beings wish them not to grow, but they are *parasites*. (b) A parasite has the definite distinction of drawing its food detrimentally and directly from a host, but to speak teleologically a weed is an honest, independent competitor for food materials in the "struggle for existence."

What seems, therefore, to be a more workable conception of a weed may be stated as follows: "A weed is an independent plant whose species is persistently obnoxious on cultivation areas." The salient words in this statement are "independent species persistently obnoxious," and these four words may be taken as a definition of a weed, as against the salient words in the old definition—"A plant growing out of place." In this new definition all parasites are excluded, and weed-craft is confined definitely to independent species that are repeatedly obnoxious to phytocultural operations.

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QUOTATIONS

REWARDS FOR SCIENTIFIC RESEARCH

SHOULD the Canadian Parliament take the action which the Canadian Premier, Mackenzie King, has announced the intention to propose, and award to Dr. F. G. Banting, the discoverer of "insulin," a life annuity of $7,500, it will be an event of importance both in itself and as an example for other nations. [Parliament has unanimously voted the annuity.] Incidentally, it will give convincing proof that the Canadian lawmakers have an intelligent appreciation of a service to the world such as has been rendered by the Toronto physician and an equally intelligent understanding of the best way to reward that service.

Professional ethics as understood among the English-speaking peoples, and most others except the Germans, will prevent Dr. Banting from exploiting the large commercial possibilities of his remedy, and the fame acquired from his achievement will be confined rather closely to his colleagues and will not pay grocers' bills. It is therefore the wisest of generosity for Canada to give to the son whose honors she shares enough to permit the devotion, without material anxieties, of the rest of his life to the form of research for which he has demonstrated his competence. Even though he never should find another specific for one of humanity's scourges, his work is sure to increase the general stock of medical knowledge.

The amount suggested as his honorarium seems large only because such appropriations of public funds are so rare. After all, it is only the interest on $150,000, and, compared with the fortunes made by other inventors—the Fords, the Edisons, the McCormicks and their like—it seems absurdly small. But it is enough, for the needs of the scientific investigator are small and, assured for himself and his family against the necessity of earning a livelihood by immediately profitable work, he will be content—will count himself, indeed, among the luckiest of mortals.

That the action of Canada in the case of Dr. Banting, if taken, will be exemplary, is not too much to hope. It will call world-wide attention to the fact that there are discoveries and inventions which should not be made the basis of a monopoly by the issuance of a patent or copyright, though, on the other hand, they should not be allowed to go unrewarded.

National governments have a duty in this matter, and one which they rarely have recognized. For the most part they have left the maintenance of scientific research to the generosity of individuals or of the few private corporations which have arrived at realization of what "pure science" can do for them. This, however, implies either the acceptance of something very much like charity—the taking of favors for which thanks must be given—or the receipt of a salary that at any moment may cease.

A government, if conducted with sufficient intelligence, would change all this. It would establish facilities for determining just what men had rendered or were likely to render services so widely beneficial that everybody should be expected to pay for them. Then it should make due provision for acquiring a discovery or invention of general benefit and offering it freely to anybody in the country, or in the world, who wants to use it.

Once, at least, our own Congress did just this—it appropriated what it considered a sufficient amount to pay the inventor of "babbitt metal" what that excellent alloy was worth, made its manufacture and use free to all, and so prevented the imposition on all users of a tax continuing as long as a patent would run. If more of this wisdom were displayed, fewer enormous fortunes would be made, perhaps, but that would be no great calamity.—*The New York Times.*

SCIENTIFIC BOOKS

The Mathematical Theory of Probabilities and its Application to Frequency Curves and Statistical Methods. By ARNE FISHER. Vol. I., *Mathematical Probabilities, Frequency Curves, Homograde and Heterograde Statistics.* Second Edition. The Macmillan Company, New York, 1922, pp. xxix + 289.

A Treatise on Probability. By JOHN MAYNARD KEYNES. The Macmillan Company, London, 1921, pp. xi + 466.

THE literature of probability, honorable in the history of science as it is, is not so extensive but that the appearance of two major works on the subject within a year of each other is a notable event. It seems appropriate to review these two books together, because they represent so perfectly what have been, throughout the history of the subject, two diametrically opposed schools of thought about the theory of probability. On the one hand we have the point of view of the person who sees in the theory of probability one of the most potent tools the human mind has ever devised for penetrating deeper into the relations and laws of phenomenal nature. This is the point of view, in short, of the natural scientist who wishes to *use* the theory of probability in the conduct of the practical business of his life in the manner of approach of Laplace, Clerk Maxwell, Willard Gibbs, Karl Pearson and a host of the greatest figures in the history of science. On the other hand is the point of view of the person who regards the theory of probability as essentially only a branch of metaphysics, and finds its usefulness in the fact that it furnishes an entertaining and involved subject to speculate and talk about.

The first of these viewpoints is represented in the book, already well known to statisticians from its first edition, of the distinguished Danish mathematician and actuary, Arne Fisher. It is a sound treatise, of excellent workmanship, on the mathematical theory of probability and its application to practical statistical problems, developed mainly from the standpoint of the Scandinavian school of Thiele, Charlier, etc. It is extremely valuable to have the ideas of this school thoroughly and clearly presented to English and American students, as is done in Fisher's book. Furthermore, there is a freshness and originality in the author's mode of exposition which is highly stimulating and entertaining to the student. Whether the methods and ideas of the Scandinavian school will supplant those of the English school, which derives from Karl Pearson, seems doubtful, so far as concerns American workers, at least. But it is a fine indication of the healthy, vigorous condition of the subject to have these two lines of great activity flourishing at the same time. This second edition of Fisher's book is considerably expanded and improved over the first. It should be in every statistical library. Not the least entertaining feature about it is the commendably vigorous language in which Fisher flays Keynes and tacks his integument up for public inspection and ridicule.

Which may suggest that the present reviewer holds the second book on our list in rather low esteem. Such is in fact the case. Leaving wholly aside, as unimportant, the flippancy, super-smartness and debonair conceit so manifest in the style in which the book is written,[1] the thing which makes it not only an unreliable guide, but in the reviewer's judgment a positively pernicious one for at least that large group of students who wish to make practical use of the theory of probability in scientific research, is its abandonment of the experiential basis of probability, and the substitution in its place of the thesis that the basis of probability is simply a logical relation, independent in respect of its ultimate philosophical validity of any experience whatever. The author rejects completely the possibility of numerically measuring a probability, except in one particular narrowly defined case. The whole thing is essentially a postulational performance. Keynes sets up certain fundamental postulates, which bear no particular relation to any known phenomenal universe, then proceeds to develop a system of consequences of these postulates, and finally takes as the criterion of validity the logical consistency of the resulting system. This process is, of course, well known in mathematics, and has served in some hands and in some fields a philosophically useful purpose. The reviewer *guesses* (he has no intention to waste the time necessary to check over the symbolic logic to prove it) that Keynes's system *is* logically consistent, if the initial postulates are granted. But this is a sterile triumph so far as the application of probability to scientific research is concerned.

Of course the book is not all bad. No book is. I can not resist quoting one passage, which seems destined to become classic, as an example of the author's powers of clear and penetrating thought, subtle reasoning and lucid exposition. It is this (p. 36):

"When we say of three objects, A, B and C, that B is more like A than C is, we mean, not that there is any respect in which B is in itself quantitatively greater than C, but that, if the three objects are placed in an order of similarity, B is nearer to A than C is. There are also, as in the case of probability, different orders of similarity. For instance, a book bound in blue morocco is more like a book bound in red morocco than if it were bound in blue calf; and a book bound in red calf is more like the book in red morocco than if it were in blue calf. But there may be no comparison between the degree of similarity which exists between books bound in red morocco and blue morocco, and that which exists between books bound in red morocco and red calf. This illustration deserves special attention, as the analogy between orders of similarity and probability is so great that its apprehension will greatly assist that of the ideas I wish to convey. We say that one argument is more probable than another (*i.e.*, nearer to certainty) in the same kind of way as we can describe one object as more like than another to a standard object of comparison."

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[1] Which leads to such choice remarks as the following (p. 180): "It may, however, be safely said that the principal conclusions on the subject set out by Condorcet, Laplace, Poisson, Cournot and Boole are demonstrably false. The interest of the discussion is chiefly due to the memory of these distinguished failures."

SPECIAL ARTICLES

ON THE EXISTENCE OF AN ANOMALOUS REFLECTION OF X-RAYS IN LAUE PHOTOGRAPHS

SPECTROMETRIC observations[1] upon crystals of potassium iodide have pointed to the existence of strong diffraction effects which could not be explained as "reflections" from any imaginable atomic planes. The positions[2] of these X-peaks, as they have been called, have been defined for various angles of diffraction and their wave lengths determined as equal to that of the characteristic radiation of iodine. Possibly related effects[3] have also been observed in the powder photographs from several metals. Very recently a Laue photograph[4] to show the presence of these anomalous reflections has been offered.

Inasmuch as the existence of such diffractions not obeying established laws must of necessity have a great influence upon the interpretations of X-ray phenomena, the study of their properties becomes of importance. Their failure to appear under the prescribed conditions may have even greater significance. The writer has obtained a number of Laue photographs of potassium iodide and no effect corresponding to these X-peaks appears on any of them.

The X-peaks are supposed[4] to show themselves in a Laue photograph taken with the incident X-rays parallel to a cube face as four *spots* symmetrically placed about the center and lying in the same zone as the (100) and (130) reflections. Their distance from the undeviated image will be[4] one centimeter if the crystal-to-plate distance is 2.5 centimeters. The recorded photograph was said to be produced by an

[1] G. L. Clark and W. Duane, *Proc. Nat. Acad. Sci.*, *8*, 90 (1922).

[2] G. L. Clark and W. Duane, *Proc. Nat. Acad. Sci.*, *9*, 131 (1923).

[3] L. W. McKeehan, *J. Opt. Soc. Am.*, *6*, 989 (1922).

[4] G. L. Clark and W. Duane, *J. Opt. Soc. Am.*, *7*, 455 (1923).

exposure which was too short to register any of the normal reflections.

The writer has prepared Laue photographs with the X-rays passing either parallel to or making small angles with the normal to a (100) face. They have been taken both with a crystal-to-plate distance of 2.5 centimeters and with the more commonly employed distance of five centimeters. Some of the exposures were at least ten times greater than necessary for the detection of the ordinary reflections from crystal faces. Four crystal specimens were used; their refractive index was determined to agree within 0.001 with that which has been assigned to pure potassium iodide.[5] Several voltages were used in the preparation of these photographs. The minimum wave length present was directly determined for a particular experiment (1) by calculating from an analysis[6] of the photograph the wave lengths of the rays giving rise to different spots and (2) by taking, under the same conditions of experimentation, a reflection photograph from a calcite crystal. In some photographs reflections were present from wave lengths as low as 0.23 A. U. (the critical absorption limit for the K-series of iodine[7] is 0.374 A. U.). In no instance was anything found upon the photographs at the points which both the published Laue photograph and the accompanying spectrometer measurements indicate as the locations of the X-peaks. Furthermore the general aspect of the Laue photographs is such that there can be no possibility of a confusion of these X-peak spots with the regular reflections occurring upon good photographs.

Potassium iodide, in common with certain other crystals, of which tin tetraiodide[8] is typical, gives hazy diffraction phenomena which are not to be directly accounted for as reflections from planes in perfectly constructed crystals. These diffractions, though they seem to occupy the same positions in different specimens, are not sharply defined; furthermore they are relatively very weak and occur at much smaller angles of deviation than obtain for the X-peaks. As a consequence it is impossible to identify the two.

These hazy diffractions seem related to the well-known "asterism" phenomenon[9] which shows itself as diffraction stripes passing along principal zones of planes in distorted crystals. A number of crystalline substances which deform readily, among which the alkali halides are conspicuous, will usually if not always show some striping from specimens which have not been subjected to external deforming forces. The observed effects with potassium iodide differ from those with other alkali halides in that, instead of a continuous stripe, the intensity is largely localized. Had it been possible to identify these hazy diffractions with the X-peaks, then a proof that the latter were due[2] to X-rays having the frequency of the characteristic radiation of iodine would have led to the possible explanation that the hazy diffractions arise from resonance iodine radiation.[10]

The writer has reexamined photographs of caesium dichloroiodide;[11] Laue exposures also have been made from a number of other crystals which, containing atoms that could emit their characteristic radiations under the action of the primary X-ray beam, might be expected to show X-peak spots. Among the photographs thus produced were ones from barite, barium nitrate and silver nitrate. On none of these was any evidence found pointing to the existence of other than the normal planar reflections.

More details of these experiments, together with reproductions of Laue photographs, will be published soon in the *American Journal of Science*.

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JUNE, 1923

[5] The writer is greatly indebted to H. E. Merwin for this determination.

[6] R. W. G. Wyckoff, *Am. J. Sci., 50,* 317 (1920).

[7] W. Duane, *Bull. Nat. Research Council, 1,* 389 (1920).

[8] R. G. Dickinson, *J. Am. Chem. Soc., 45,* 958 (1923).

[9] G. Aminoff, *Geol. För. Förh., 41,* 534 (1919); E. Hupka, *Physikal. Z., 14,* 623 (1913); F. M. Jaeger, *Proc. Roy. Soc. Amsterdam, 18,* 3; F. Rinne, *Ber. Sächs. Akad. Wiss. Leipzig* (Math.-phys. Klasse), *67,* 303 (1915).

[10] G. L. Clark and W. Duane, *Proc. Nat. Acad. Sci., 9,* 126 (1923).

[11] R. W. G. Wyckoff, *J. Am. Chem. Soc., 42,* 1100 (1920).

THE BIOCHEMICAL SULFUR OXIDATION AS A MEANS OF IMPROVING ALKALI SOILS[1]

THE problem of reclaiming alkali soils, especially black alkali, has been studied at various experiment stations and methods for amelioration of the alkali conditions have been suggested. The methods might be divided into mechanical and chemical. The former consists in either surface washing off of the salts or leaching out. The chemical method consists in treating the soil with gypsum whereby the conversion of the carbonates and bicarbonates into sulfates takes place. Recently Lipman suggested a biochemical method whereby the oxidation of sulfur by microorganisms and the production of sulfuric acid might be utilized in converting the carbonates into sulfates. The advantages of this method over the gypsum method is the difference in the reversibility of the reactions in

[1] The authors share equal responsibility and credit for the work reported.

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